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Stochastic evolutionary-based optimization for rapid diagnosis and energy-saving in pilot- and full-scale Carousel oxidation ditches

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Supporting Information

Real-time simulation and stochastic evolutionary-based optimization in pilot-scale and full-scale Carrousel oxidation ditches

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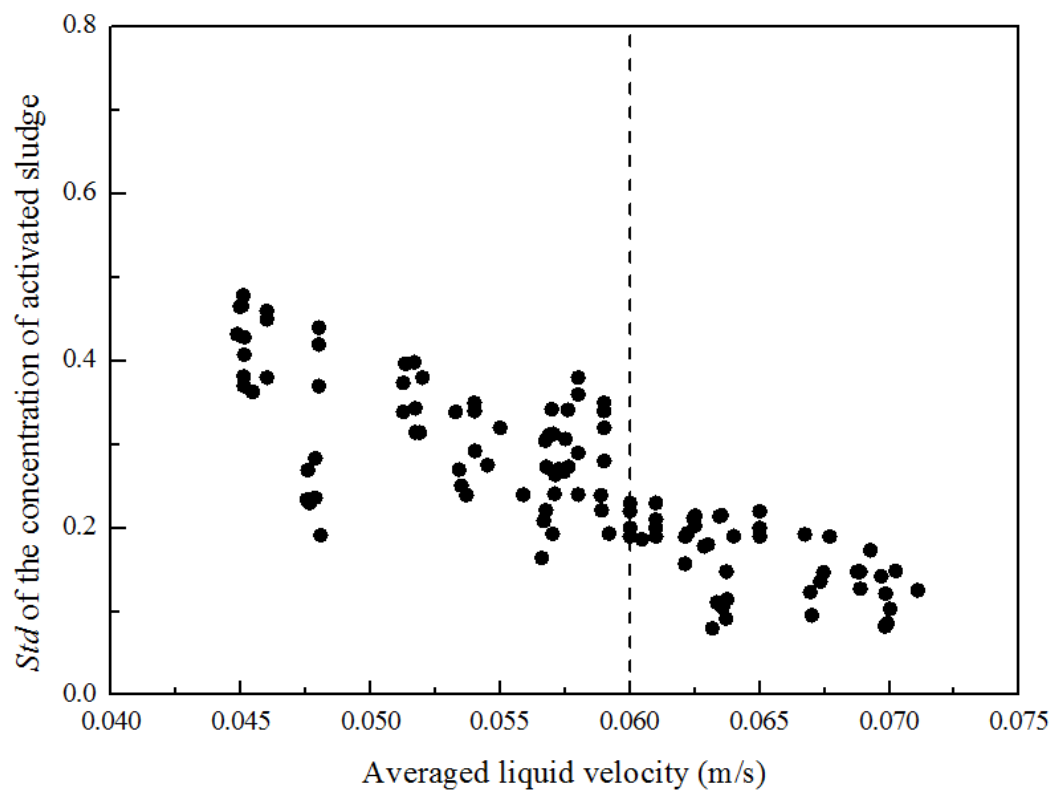


Fig. S1 Correlation between averaged liquid velocity and standard deviation of MLSS concentration over a range of operational modes in a pilot-scale oxidation ditch.

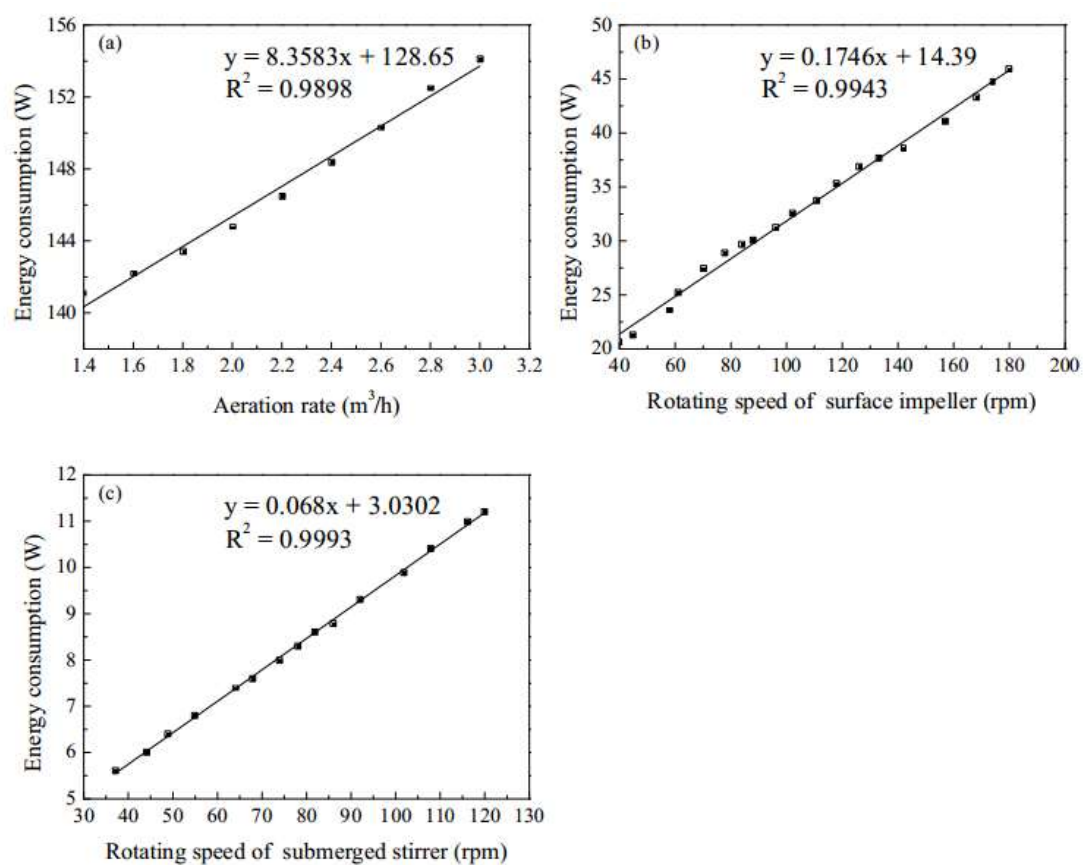


Fig. S2 Energy consumption of: (a) aeration device, (b) surface impeller, and (c) submerged stirrer over the operational range of the pilot-scale OD.

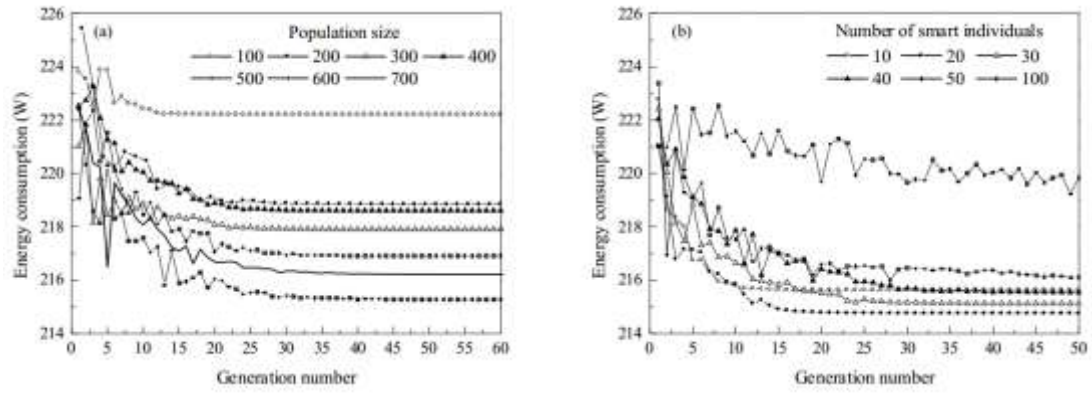


Fig. S3 Effect of (a) population size and (b) number of smart individuals on the optimization results obtained by the AGA module for the pilot-scale OD.

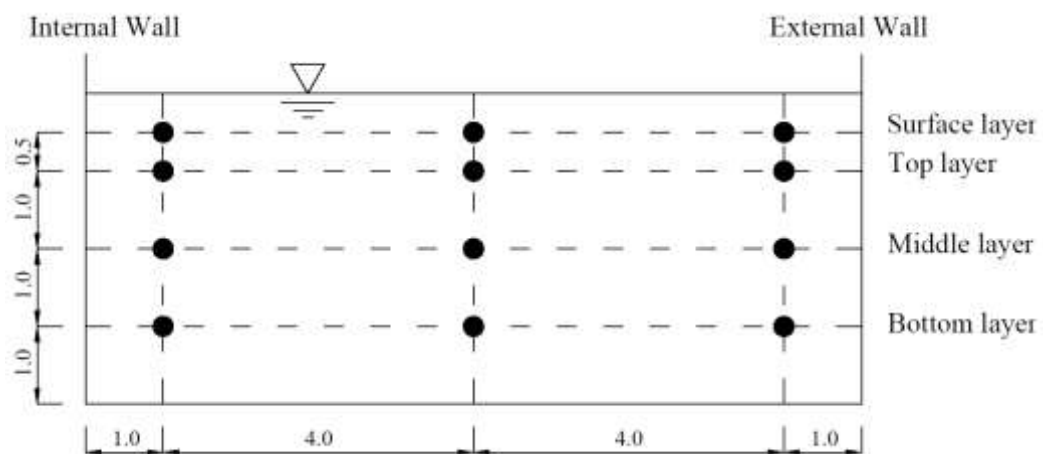


Fig. S4 Sketch indicating sampling locations in the full-scale oxidation ditch at Ping Dngshan, Henan Province, China (Unit: m).

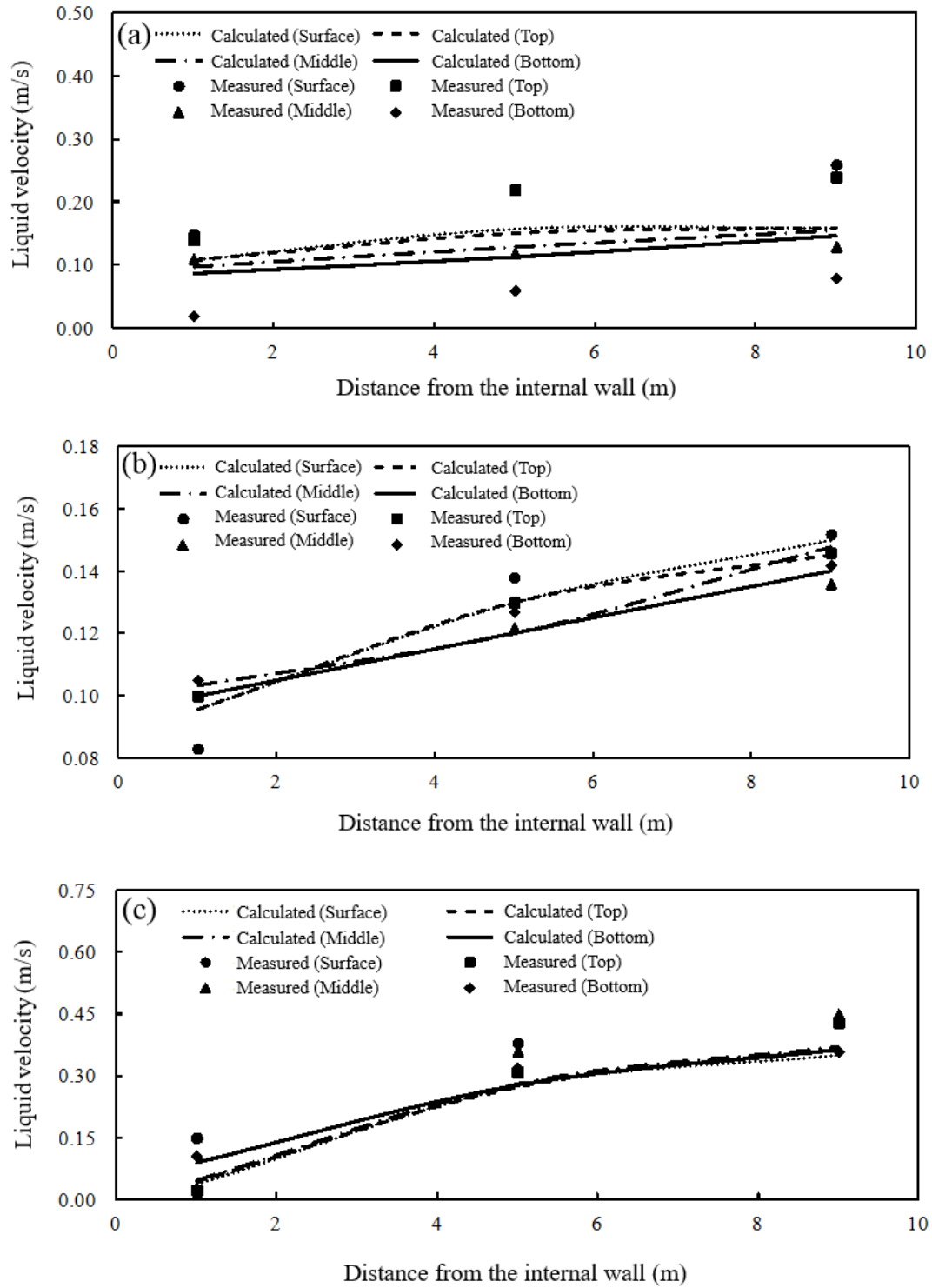
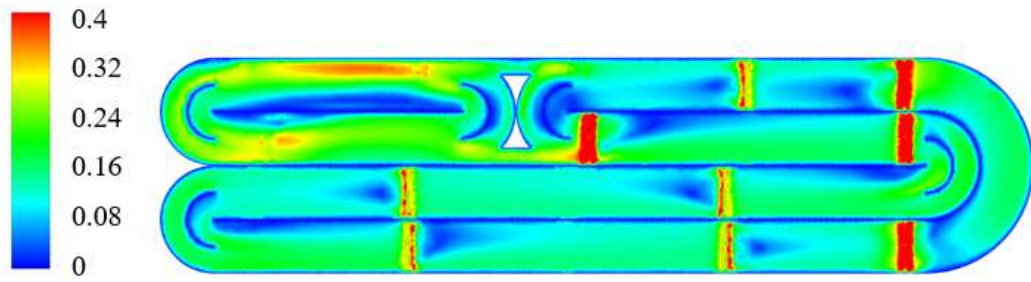
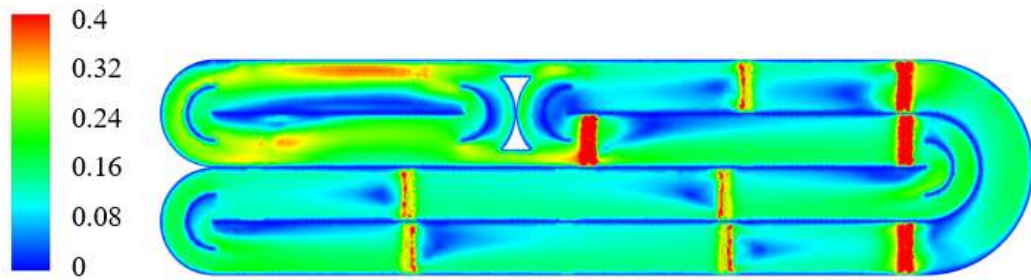


Fig. S5 Predicted and measured transverse profiles under existing operating conditions of horizontal liquid speed across: (a) Section 1-1, (b) Section 2-2, and (c) Section 3-3 of the full-scale OD at Ping Dingshan, Henan Province, China.

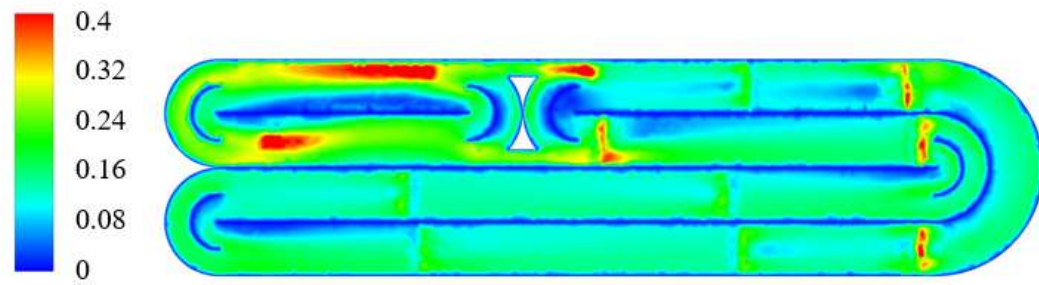
(a) Liquid velocity (m/s)



(b) Liquid velocity (m/s)



(c) Liquid velocity (m/s)



(d) Liquid velocity (m/s)

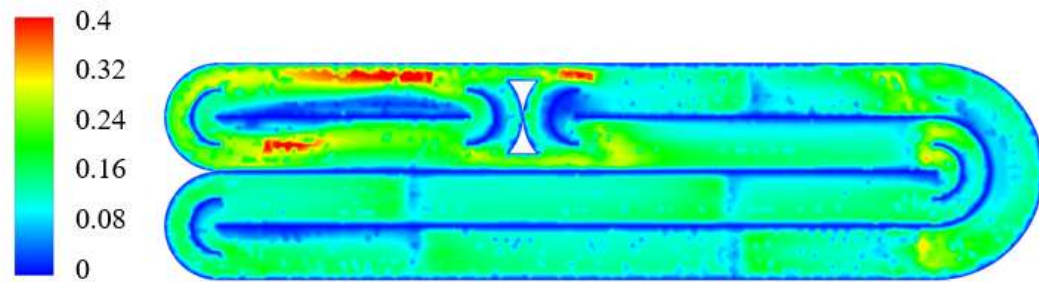


Fig. S6 Predicted horizontal flow speeds in four horizontal slices through the depth: (a) surface layer, (b) top layer, (c) middle layer, and (d) bottom layer of the full-scale OD at Ping Dingshan, Henan Province, China.

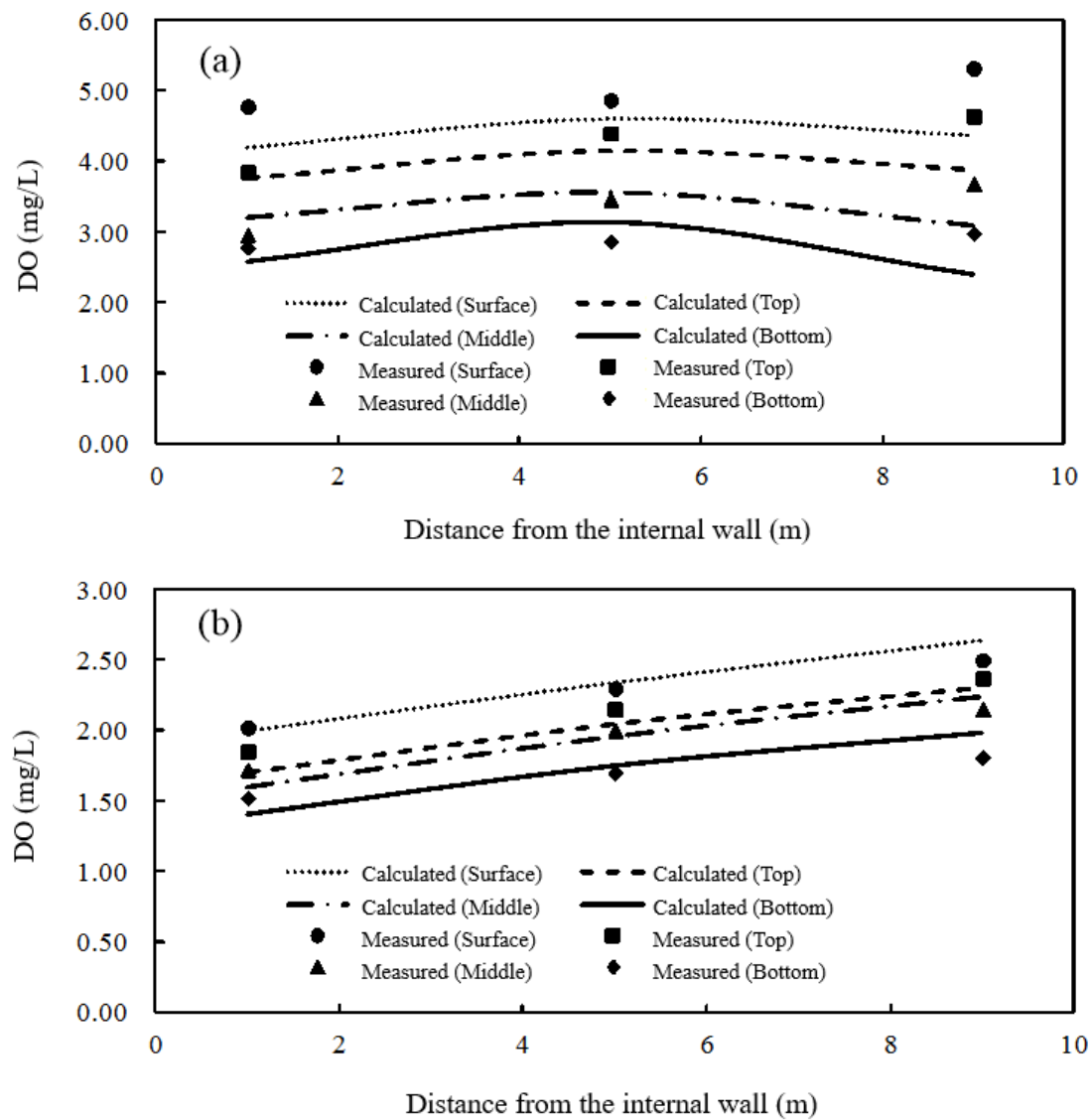


Fig. S7 Simulated and measured dissolved oxygen concentration distributions at: (a) Section 2-2, and (b) Section 3-3 of the full-scale OD at Ping Dingshan, Henan Province, China.

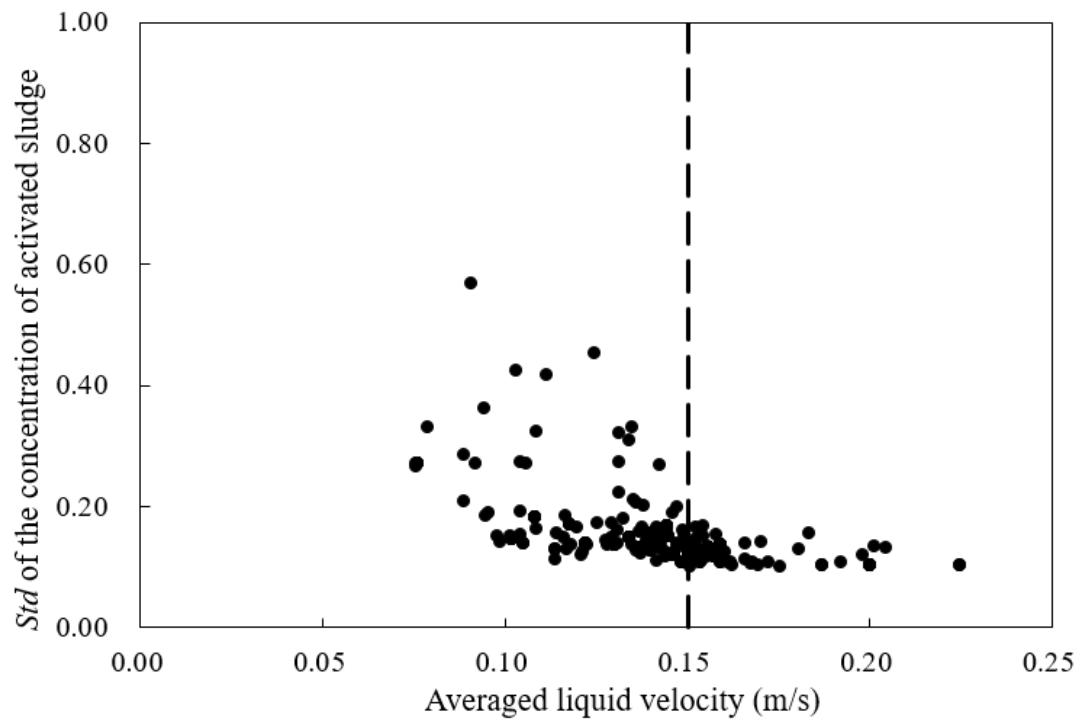


Fig. S8 Correlation between average liquid velocity and standard deviation of MLSS concentration under different operation modes for the full-scale oxidation ditch at Ping Dingshan, Henan Province, China.

Tale S1 Characteristics of influent and effluent water quality of full-scale oxidation ditch at Pingdingshan, China, under existing operating condition.

Parameters	COD	BOD ₅	TN	Ammonia nitrogen
Influent (mg/L)	333.1	92.2	35.1	24.7
Effluent (mg/L)	26.1	8.2	19.7	2.0

Table S2 Measured and simulated effluent water quality parameters under existing operating condition for the full-scale oxidation ditch at Ping Dingshan, China.

Parameters	Measured	Calculated
COD (mg/L)	26.1	28.5
Ammonia nitrogen (mg/L)	2.0	2.3
TN (mg/L)	19.7	18.0